New Frontiers Presolicitation Conference
July 23, 2002

Colleen N. Hartman, Director
Solar System Exploration Division
Office of Space Science
NASA Headquarters

New Frontiers = Discovery Plus

New Frontiers Overview

- **Program** for supporting medium-class (<$650M) solar system missions
- Discovery-like program: regular selections, launches
- Frequent access to space: every three years
- Can use domestic RTGs
- Can use larger launch vehicles (domestic)
- Selection will be similar to Discovery and Mars Scout programs

Allowable Mission Targets

- Since these are larger missions, more complicated proposals, we propose to limit the scope in any given proposal cycle to lessen proposal burden on the community
  - Reduce proposal preparation cost and time
  - Reduce peer review difficulty of reviewing a large number of unrelated proposals
- In general, over the life of the program, we intend to span a variety of science goals, destinations, targets
- Excludes Mars, Earth, Sun

Four Scientific Themes

- The NRC Decadal Study ("New Frontiers in the Solar System" published by the Space Studies Board of the National Research Council) divided solar system exploration priorities into 4 scientific themes for the decade from 2003-2013:
  - The first billion years of solar system history
  - Volatiles and organics: The stuff of life
  - The origin and evolution of habitable worlds
  - Processes: How planetary systems work

5 Strawman Missions

These four themes and more than 100 proposed investigations were distilled into 12 Fundamental Questions, which can be addressed (in various combinations) by 5 strawman missions:

- Kuiper Belt Pluto mission (KPB)
- Lunar South Pole Aitken Basin mission (SPA-SR)
- Jupiter Polar Orbiter with Probes (JPOP)
- Venus *In Situ* Explorer (VISE)
- Comet Surface Sample Return (CSSR)

Twelve Key Scientific Questions → Missions:

The first billion years of solar system history - - -

1. **What processes marked the initial stages of planet formation?**
   - **Comet surface sample return (CSSR)**
   - **Kuiper belt/Pluto (KBP)**
   - **South pole Aitken basin sample return (SPA-SR)**
2. **Over what period did the gas giants form, and how did the birth of the ice giants (Uranus, Neptune) differ from that of Jupiter and its gas-giant sibling, Saturn?**
   - **Jupiter polar orbiter with probes (JPOP)**
3. **How did the impactor flux decay during the solar system's youth, and in what ways(s) did this decline influence the timing of life's emergence on Earth?**
   - **Kuiper belt/Pluto (KBP)**
   - **South pole Aitken Basin sample return (SPA-SR)**

Twelve Key Scientific Questions → Missions:

Volatiles and Organics: The stuff of life- - -

4. **What is the history of volatile compounds, especially water, across our solar system?**
   - **Comet Surface Sample Return (CSSR)**
   - **Jupiter Polar Orbiter with Probes (JPOP)**
5. **What is the nature of organic material in our solar system and how has this matter evolved?**
   - **Comet Surface Sample Return (CSSR)**
   - **Cassini Extended mission (CASx)**
6. **What global mechanisms affect the evolution of volatiles on planetary bodies?**
   - **Venus In-situ Explorer (VISE)**
   - **Mars Upper Atmosphere Explorer (MAO)**

Twelve Key Scientific Questions → Missions:

The origin and evolution of habitable worlds- - -

7. **What planetary processes are responsible for generating and sustaining habitable worlds, and where are the habitable zones in our Solar System?**
   - **Europa Geophysical Explorer (EGE)**
   - **Mars Smart Lander (MSL) • Mars Sample Return (MSR)**

8. **Does (or did) life exist beyond the Earth?**
   - **Mars Sample Return (MSR)**

9. **Why have the terrestrial planets differed so dramatically in their evolutions?**
   - **Venus In-situ Explorer (VISE) • Mars Smart Lander (MSL)**
   - **Mars Long-lived Lander Network (MLN) • Mars Sample Return (MSR)**

10. **What hazards do solar system objects present to Earth's biosphere?**
    - **Large-aperture Synoptic Survey Telescope (LSST)**

Twelve Key Scientific Questions: Missions:

Processes: How planetary systems work- - -

11. How do the processes that shape the contemporary character of planetary bodies operate and interact?

- **Kuiper Belt / Pluto (KBP)** • **South Pole Aitken Sample Return (SPA-SR)**
- **Cassini Extended mission (CASx)** • **Jupiter Polar Orbiter with Probes (JPOP)**
- **Venus In-situ Explorer (VISE)** • **Comet Surface Sample Return (CSSR)**
- **Europa Geophysical Explorer (EGE)**
- **Mars Smart Lander (MSL)** • **Mars Upper Atmosphere Orbiter (MAO)**
- **Mars Long-lived Lander Network (MLN)** • **Mars Sample Return (MSR)**

12. What does our solar system tell us about the development and evolution of extrasolar planetary systems, and vice versa?

- **Kuiper Belt / Pluto** • **Jupiter Polar Orbiter with Probes (JPOP)**
- **Cassini Extended mission (CASx)**
- **Large-aperture Synoptic Survey Telescope (LSST)**

The first AO

- These 12 Fundamental Questions are the top science priorities for New Frontiers
- The first AO in the New Frontiers program will be released this Fall
- The first AO will solicit mission proposals for two or more of the Decadal Survey's top five medium-class investigations
- Proposals are NOT limited to the strawman architectures outlined in the Decadal Survey, but they must be able to address the same scientific goals
- More information will be available on the New Frontiers website, http://www.centauri.larc.nasa.gov/newfrontiers/

The New Frontiers program will address the top science questions in Solar System Exploration, as identified by the solar system community in the National Research Council's Decadal Survey:

"Our future decisions will be science-driven, not destination-driven"

-- Sean O'Keefe, 4-12-02

Release of NASA's Vision and Mission

(optional slides follow)

Criteria Used for Judging Priorities:

- **Scientific Merit:**
  - •Is there a possibility of creating or changing a paradigm?
  - •Does new knowledge have a pivotal effect on research?
  - •Does the new knowledge substantially strengthen to factual data base of our understanding?
- **Opportunity**
- **Technological readiness**

Recent Significant Discoveries in Solar System Exploration:

- Discovery of extrasolar planetary systems
- Discovery of the Kuiper Belt
- Possible subsurface oceans within the icy Galilean satellites
- Evidence that Mars might have been hospitable to life in the past
- Disputed evidence for life on ancient Mars
- Identification of Chixulub crater and observations of giant impacts of comet fragments on Jupiter